

4.0 LAUNCH

4.1 PRE-LAUNCH SSV/PAD DEBRIS INSPECTION

Due to the long interval between launch attempts, the cracks in the +Y longeron closeout TPS were re-assessed. PR ET-102-TS-0012 documented the location and size of the cracks, which were accepted by MRB use-as-is for flight. The condition of the cracks during any subsequent cryoloadings would be compared to this baseline.

Superficial foam damage on the LO2 feedline attach brackets at ET stations XT-1129, -1377, and -1623 were documented on PR ET-102-TS-0013, -0014, and -0015 with MRB approval to fly-as-is.

A second pre-launch debris inspection of the launch pad and Shuttle vehicle was performed on 18 May 2000. The only discrepancy noted was a black string, possibly part of a fabric tether, on the ET crossbeam. No action was recommended with the expectation the high winds at the pad would blow the tether off the flight hardware before liftoff.

Some time later, another debris concern involved the detection of a small braided tether cable (metal) resting on the ET crossbeam +Z side. The tether was estimated to be 5-6 inches in length, 1/16 to 1/8 inches in diameter, and a mass of 2 grams. The tether most likely fell from the upper levels of the RSS during platform securing operations prior to RSS rollback. Since the OWP's had been retracted already, no action to remove the tether was recommended based on the tether's minimal debris threat to the flight hardware. IPR 101V-0331 was taken with disposition showing the aft location at XT-2048 was no worse than high density ice from the ET/ORB umbilicals near this location, and initial flight aerodynamic cross flow would push the tether outboard away from Orbiter tiles. As a worst case scenario with the tether moving toward tiles, there would be an insignificant aerodynamic acceleration due to the low cross-sectional frontal area resulting in little or no damage. MRB approved the condition to use as-is.

4.2 FINAL INSPECTION

The Final Inspection of the cryoloaded vehicle was performed on 19 May 2000 from 0015 to 0145 hours during the two hour built-in-hold at T-3 hours in the countdown. There were no Launch Commit Criteria (LCC) or OMRS criteria violations. There were no acreage icing concerns. There were also no protuberance icing conditions outside of the established database.

A portable Shuttle Thermal Imager (STI) infrared scanning radiometer was utilized to obtain vehicle surface temperature measurements for an overall thermal assessment of the vehicle, particularly those areas not visible from remote fixed scanners, and to scan for unusual temperature gradients.

4.2.1 ORBITER

No Orbiter tile or RCC panel anomalies were observed. The RCS thruster paper covers were intact but four covers (F2U, F3L, F4D, R1R) were discolored. Ice/frost had formed on the SSME #1 and #2 heat shield-to-nozzle interfaces. The SSME #3 heat shield was dry.

4.2.2 SOLID ROCKET BOOSTERS

SRB case temperatures measured by the STI radiometers were close to ambient temperatures. All measured temperatures were above the 34 degrees F minimum requirement. The predicted Propellant Mean Bulk Temperature supplied by THIO was 73 degrees F, which was within the required range of 44-86 degrees F.

4.2.3 EXTERNAL TANK

The ice/frost prediction computer program 'SURFICE' was run as a comparison to infrared scanner point measurements.

During this fourth cryogenic loading, the Final Inspection Team observed light condensate on the LO2 tank acreage. Surface temperatures averaged 57 degrees F. There were no TPS anomalies.

No significant anomalies were present in the intertank TPS. The 14 stringer valley TPS cracks detected during the previous cryoloads had increased to a total of 15 with the appearance of an additional hairline crack in the -Y-Z quadrant. Ice and frost accumulations on the GUCP were typical.

Light condensate was present on the LH2 tank acreage. Surface temperatures ranged from 58 to 66 degrees Fahrenheit. There were no acreage TPS anomalies.

Typical amounts of ice/frost had accumulated in the LO2 feedline bellows and support brackets. Also as expected for a fourth cryoload, there were numerous small frost spots on various closeout bondlines including two places on the -Y bipod housing closeout bondline.

The 5-inch dogleg stress relief crack in the -Y vertical strut TPS and separate 3-inch long crack had not changed significantly since the last cryoload. This condition has been accepted for flight on previous vehicles.

The cracks and ice/frost accumulations in the +Y longeron closeout TPS as documented prior to tanking had not changed. Therefore, no new IPR was required.

There were no TPS anomalies on the LO2 ET/ORB umbilical. Ice/frost accumulations were present on the aft and inboard sides. Ice/frost fingers on the separation bolt pyrotechnic canister purge vents were typical.

Ice and frost in the LH2 recirculation line bellows and on both burst disks was typical. Likewise, a typical amount of ice/frost had accumulated on the LH2 ET/ORB umbilical purge barrier outboard side, forward, and aft surfaces. Typical ice/frost fingers were present on the pyro canister and plate gap purge vents. No unusual vapors or cryogenic drips had appeared during tanking, stable replenish, and launch.

Overall, the ET was in excellent condition for a fourth cryogenic loading with no significant changes from the previous tanking.

4.2.4 FACILITY

All SRB sound suppression water troughs were filled and properly configured for launch. No leaks were observed on the GUCP or the LO2 and LH2 Orbiter T-0 umbilicals.

4.3 T-3 HOURS TO LAUNCH

After completion of the Final Inspection on the pad, surveillance continued from the Launch Control Center. Twenty-two remote-controlled television cameras and two infrared radiometers were utilized to perform scans of the vehicle. No ice or frost on the acreage TPS was detected. Protuberance icing previously assessed did not increase. At T-2:30, the GOX vent seals were deflated and the GOX vent hood lifted. Although frost covered some of the ET nose cone louvers - an expected condition - no ice was detected. When the heated purge was removed by retraction of the GOX vent hood, frost continued to form on the louvers until liftoff. At the time of launch, there were no ice accumulations in the "no ice zone".

STS-101 was launched at 140:10:11:09.994 UTC (6:11 a.m. local) on 19 May 2000.

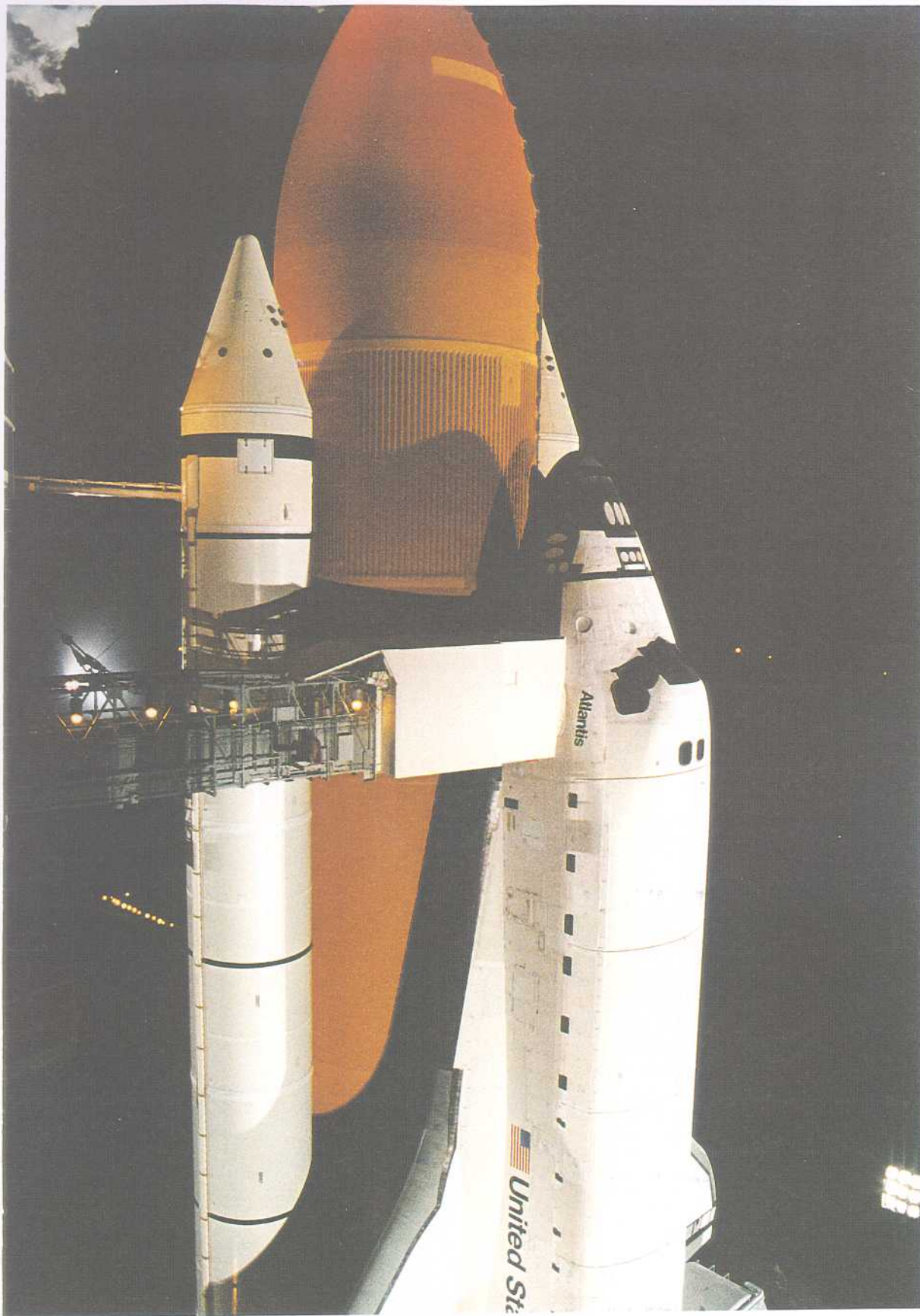


Photo 5: ET LO2 Tank and Intertank

During this fourth cryoload, the External Tank was in excellent condition. The Final Inspection Team observed light condensate on the LO2 tank acreage. Surface temperatures averaged 57 degrees Fahrenheit. No TPS anomalies were detected.



Photo 6: LH2 Tank Acreage

Light condensate was present on the LH2 tank acreage. Surface temperatures ranged from 58 to 66 degrees Fahrenheit. There were no acreage TPS anomalies.

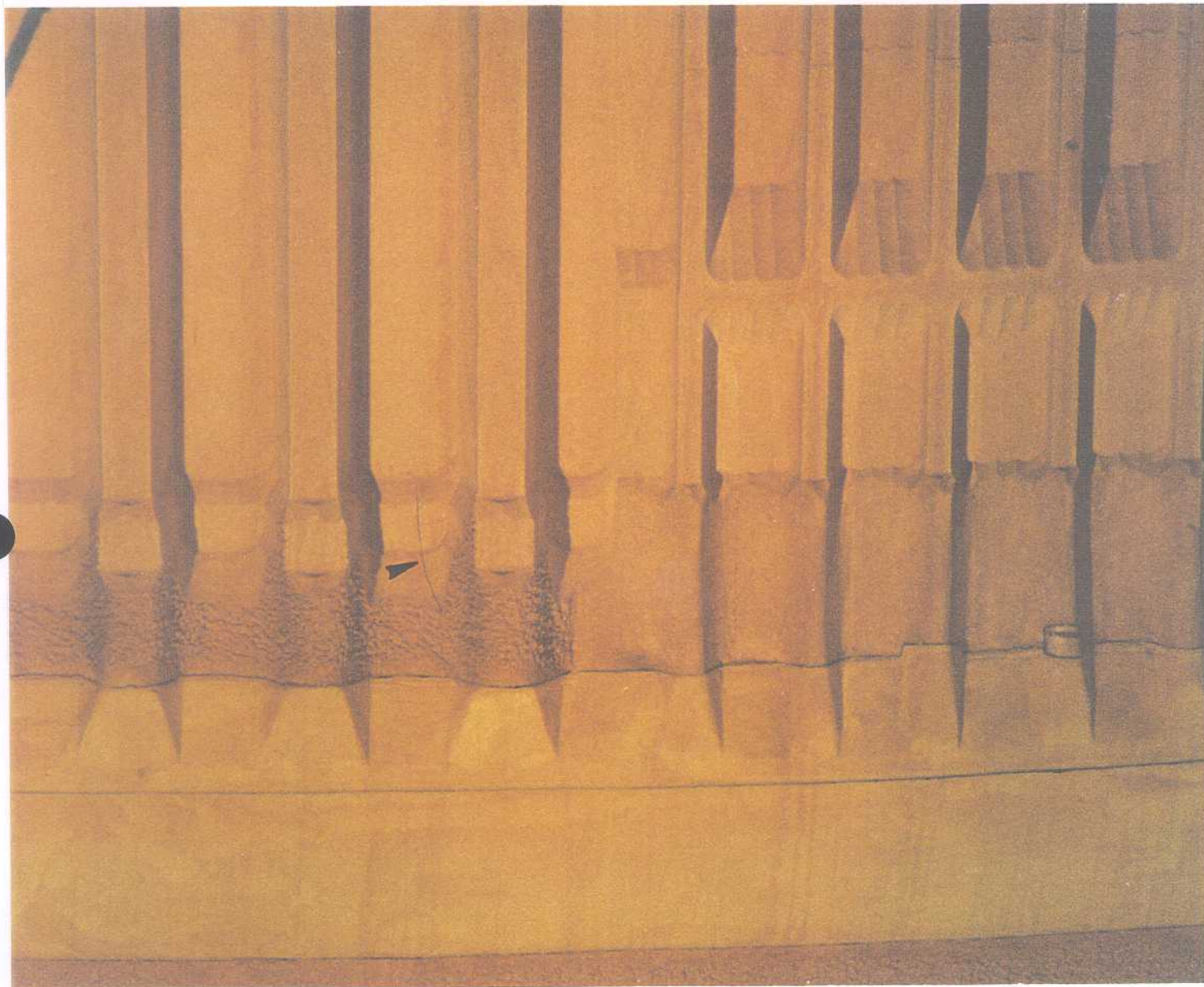


Photo 7: Cracks in Intertank Stringer Valleys

No significant anomalies were present in the intertank TPS. The 14 stringer valley TPS cracks detected during the previous cryoloads had increased to a total of 15 with the appearance of an additional hairline crack in the -Y-Z quadrant.



Photo 8: ET +Y Longeron

As typically happens during multiple cryogenic loadings, randomly scattered thermal shorts produced small ice/frost formations as seen here in the +Y longeron closeout foam

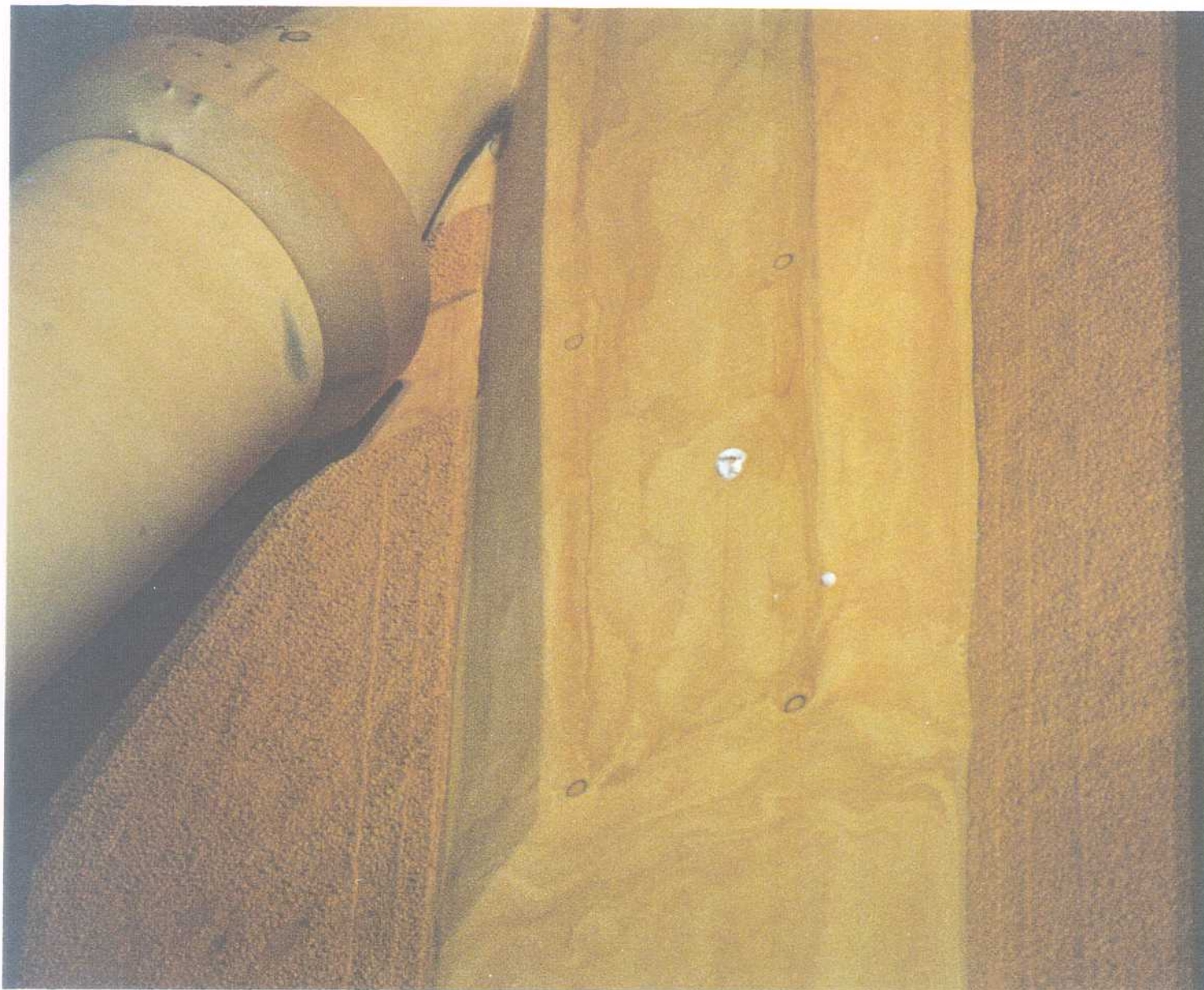


Photo 9: ET +Y Longeron TPS

The cracks and ice/frost accumulations in the +Y longeron closeout TPS documented prior to tanking had not changed. Therefore, no new IPR was required.

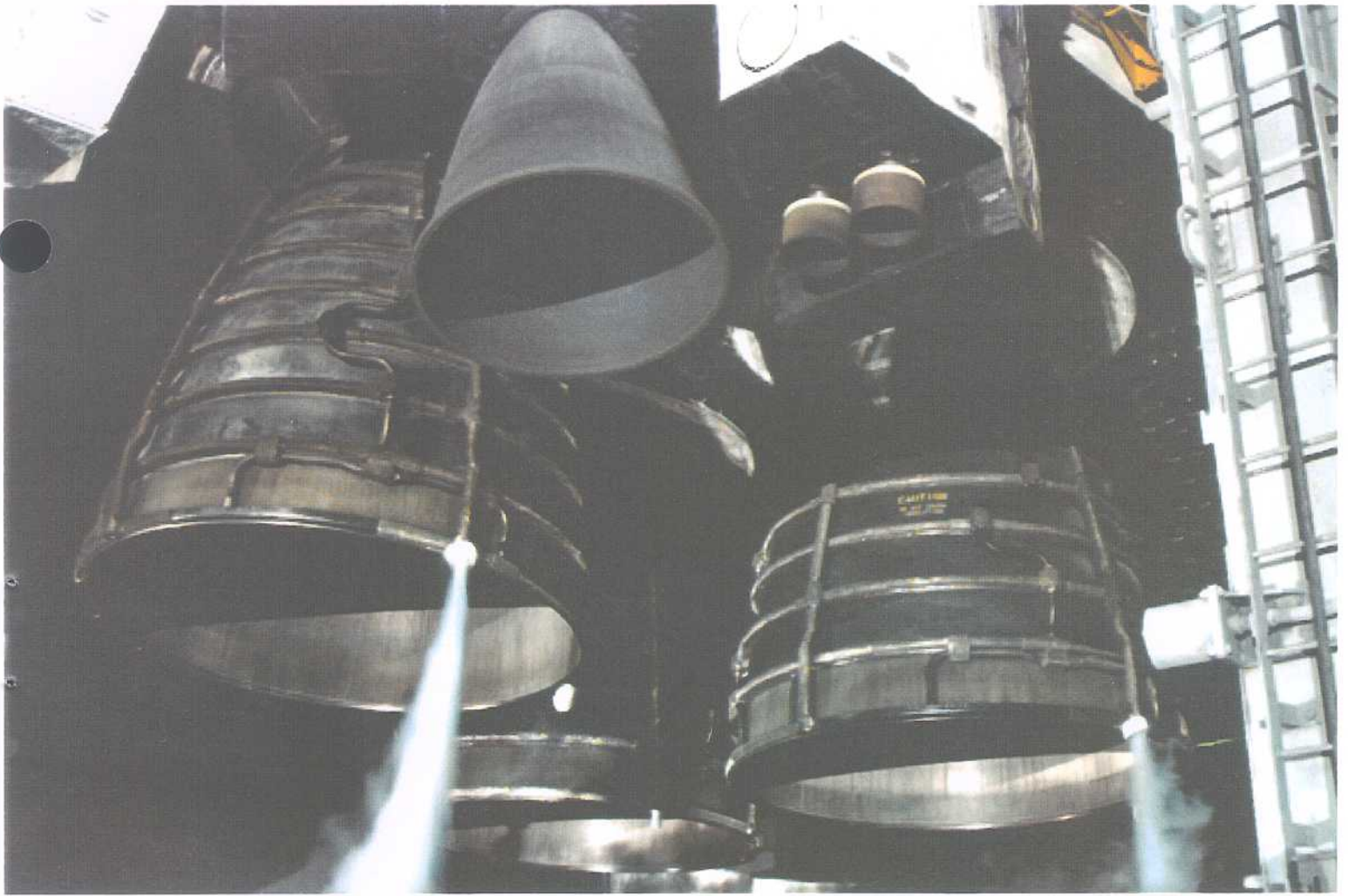


Photo 10: Overall View of SSME's